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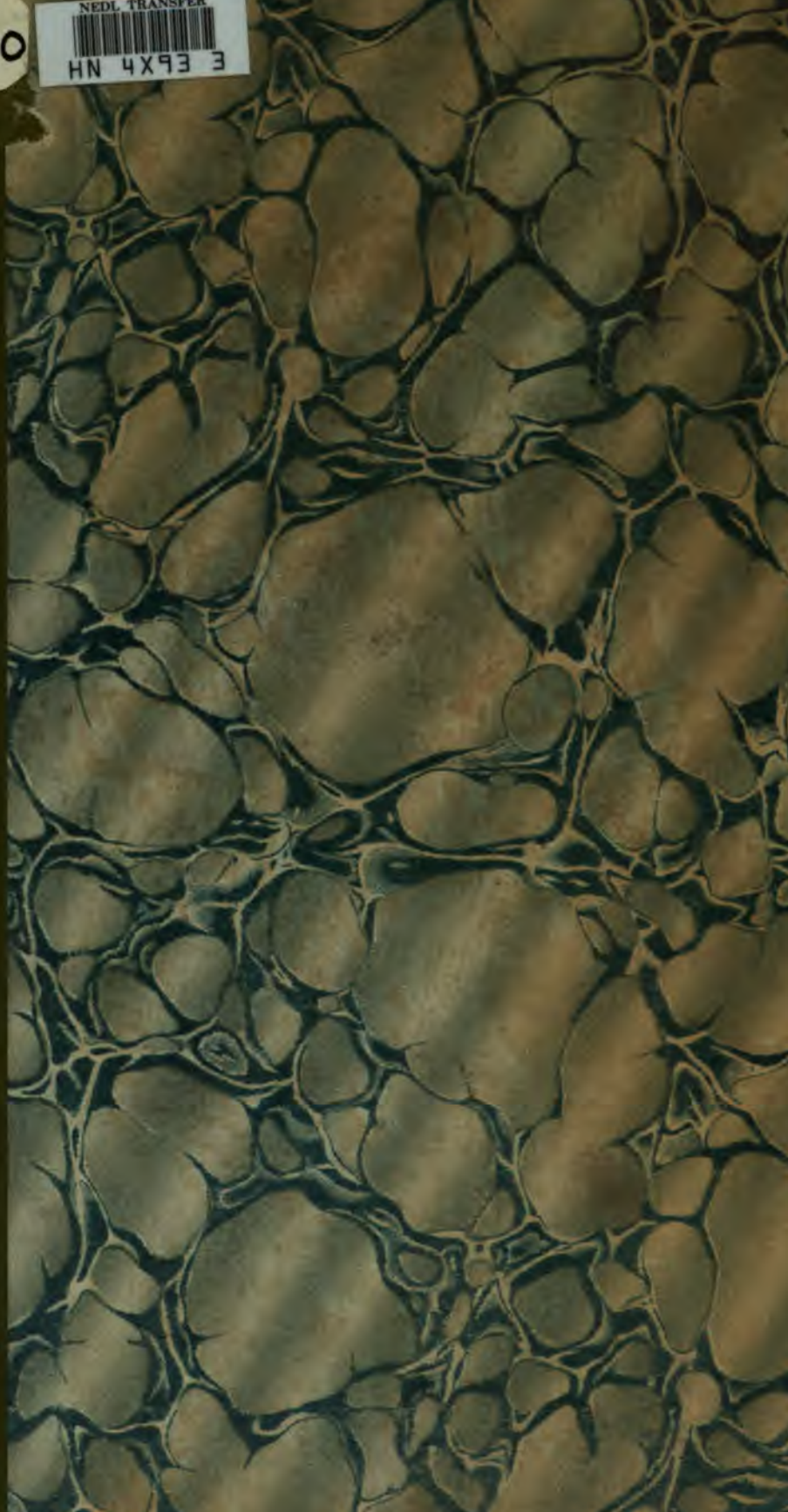
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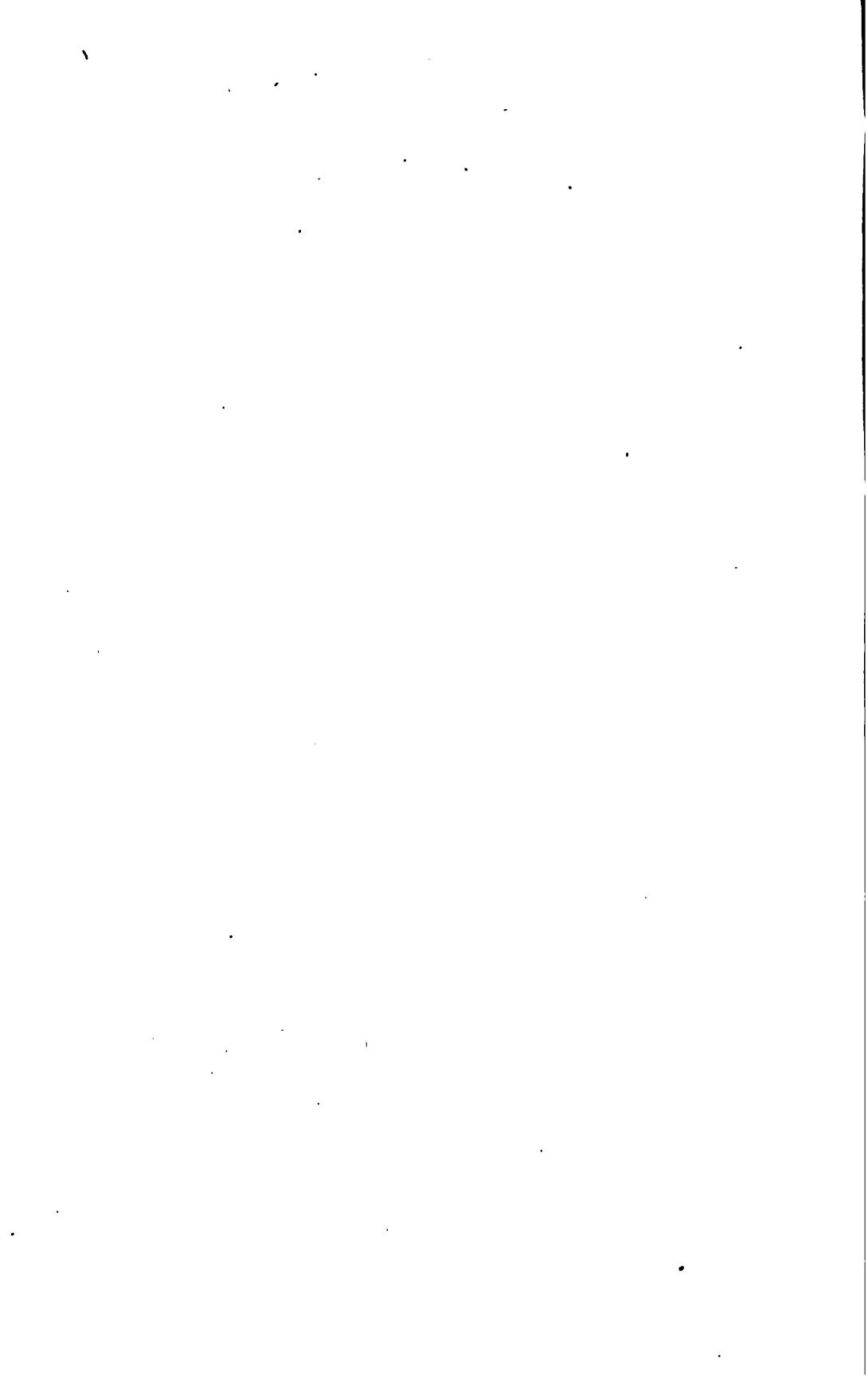
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HOW TO DESCRIBE A FLOWERING PLANT.

DETAILED DIRECTIONS FOR ANALYSIS BASED
ON GRAY'S LESSONS IN BOTANY.

— BY —

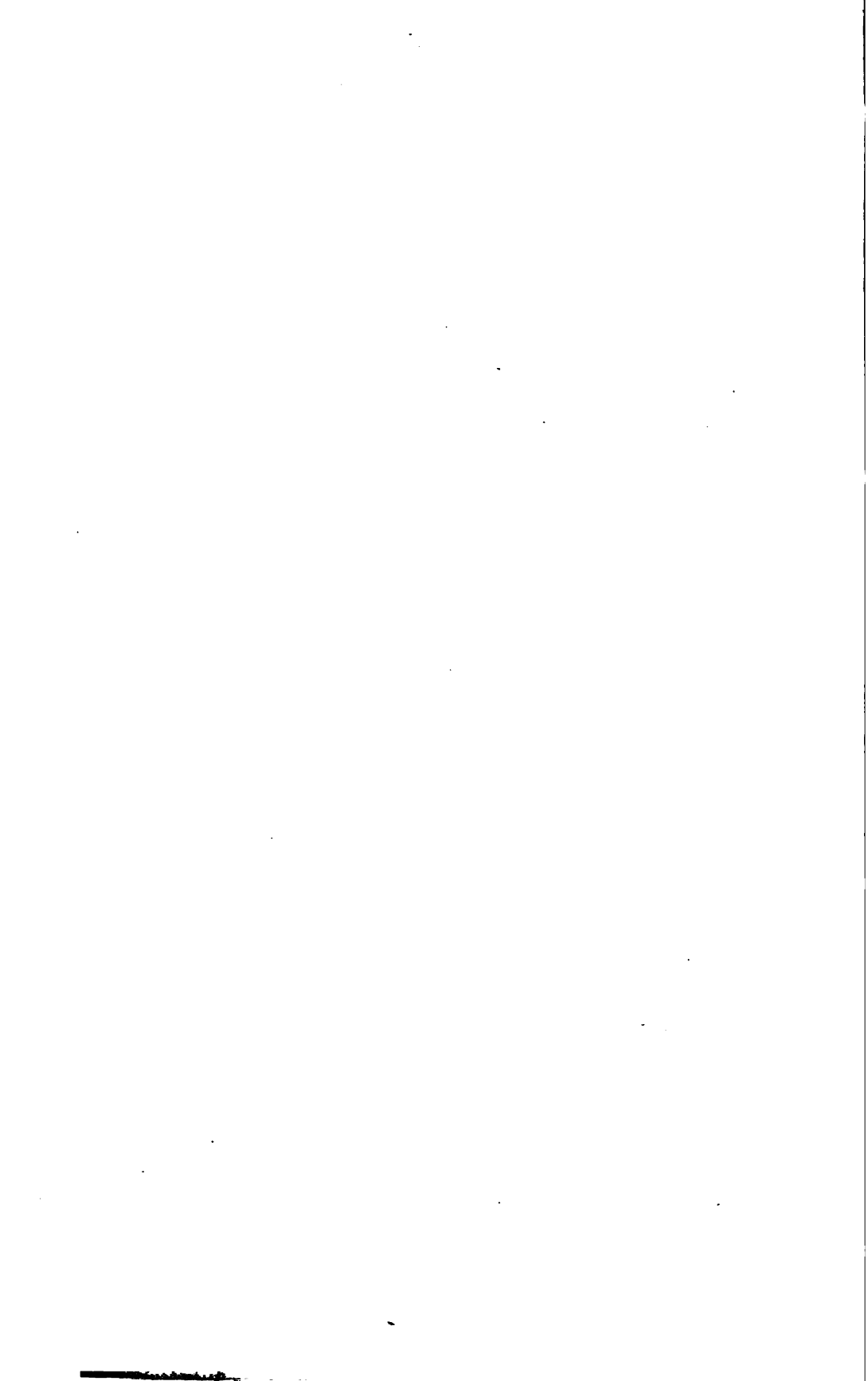
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FORMERLY TEACHER IN THE HARVARD SUMMER SCHOOL OF BOTANY, AND IN-
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INTRODUCTION.

The generally recognized importance of some training in plant description as a preliminary to the use of systematic botanical writings renders unnecessary any excuse for the present attempt to facilitate such work.

As tested practically with elementary classes, the plan here proposed has yielded gratifying results. It consists essentially, as will be seen, in the use of a schedule of questions, which, presuming such knowledge of a given topic as may be gained from the text-book, tests that knowledge and directs the student's attention to what is most important for him to observe in the specimen at hand. The questions are so framed as to indicate the alternatives commonly presented and the terms most used to express them. By referring to the book for the meaning of such terms as are not remembered, and consciously choosing the ones that fit, the technical expressions become fixed in the memory and associated not only with mere definitions but with features of the objects actually observed. Special care has been taken to have the questions follow a convenient and logical sequence.

As compared with the several "plant records" and other artificial devices which have been offered for this purpose, it is believed that the present scheme will be found superior in the following points: (1.) Pupils are led to express themselves in good, clear English. (2.) They are not cramped for room when considerable needs to be said, and there is not imposed that mechanical rigidity which renders a description strained, uneven and inadequate for the expression of anything at all unusual. (3.) The whole tendency of the system is to lead the student to less and less dependence on artificial help in his work, so that finally he shall be able to give orally or write, unaided, a full, accurate, terse, well-worded botanical description of any flowering plant, just as a botanist would. (4.) Much time is saved by the use of

FLORAL FORMULAS.

The purpose of a floral formula is to express in the briefest manner and yet clearly, certain fundamental facts in the organi-

zation of a flower. It thus saves many words and shows at a glance much that is of most importance in a systematic description.

In the writing of a formula, S stands for sepals, P for petals, SP for perianth, A for stamens bearing fertile anthers, a for stamens with rudimentary anthers or none, C for carpels producing ovules, and c for sterile or rudimentary carpels.

A number following one of these letters indicates how many there are in a row of the organs designated; e. g. $S_3P_0A_3+3C_1$ means sepals three, petals none, stamens six, in two rows of three each, carpel one.

A single whole number, like those given, implies that the members of the set are alike; that is to say that the flower is, in so far, regular. When any one of the floral whorls is irregular, the number takes a fractional form, the numerator indicating the number of upper, and the denominator the number of lower organs in the whorl, so that a corolla, for example, which consisted of two upper and three lower petals would be represented by $P_{\frac{2}{3}}$.

Coalescence is indicated by inclosing the number in a parenthesis when the organs are united throughout the greater part of their length; e. g. $P(5)$ means that the corolla is composed of five petals united more than halfway up. When the sepals or petals are united no more than halfway up, or when stamens are united only by their filaments or carpels only by the ovary, this is indicated by substituting for the large parenthesis, a small one below the middle; e. g. $A_{(10)}$ means "stamens ten, monadelphous." If, on the other hand, the coalescence is confined to the upper part, this is indicated by substituting a small parenthesis above the middle; e. g. $A^{(5)}$ means "stamens five syngeneisous."

When the stamens are grouped in several sets, this may be indicated by putting after the number of the stamens the sign of division followed by the number of the sets: $A_{(\infty \div 3)}$ would thus mean "stamens numerous triadelphous."

Adnation is expressed by means of brackets enclosing the symbols of the adnate organs, e. g.: $[P(5)A_5]$ means "stamens five inserted on the pentamerous gamopetalous corolla."

When the ovary is inferior this is indicated by a line placed over the number of the carpels, e. g.: $C_{(3)}$ represents a pistil of

three united carpels and an inferior ovary. When the ovary is half-inferior, *i. e.*, when the stamens and petals are perigynous this may be indicated by a dash preceding the carpel number, e. g., C—1, means "pistil monocarpellary, ovary half-inferior."

When nothing to the contrary is indicated it may be assumed that the members of successive whorls alternate, since this is by far the commonest condition. Whenever the parts are opposite to those of the next whorl two vertical parallel lines placed between them will serve to express this fact, e. g., P(5)||A5, means that the five stamens are opposite to the five lobes of the corolla.

To the above examples may now be added formulas of a few common flowers, the structure of which is shown more or less fully by figures in the Lessons. If the student will compare the formulas with the illustrations referred to or with the descriptions given in the Manual, the use and understanding of these labor-saving expressions ought to present no further difficulty.

Sedum (Fig. 222)	S ₅ P ₅ A ₅ +5C ₅ .
Crassula (224-5)	S ₅ P ₅ A ₅ C ₅ .
Trillium (226-7)	S ₃ P ₃ A ₃ +3C(3).
Mamillaria (229)	S _∞ P _∞ A _∞ C _∞ .
Moonseed (231)	♂ S ₆ P ₆ A _∞ Co.
(232)	♀ S ₆ P ₆ a ₆ C ₃ .
Anemone (233)	S ₅ P ₀ A _∞ C _∞ .
Saururus (234)	S P ₀ A ₆ C ₍₃₎ .
Mustard (235)	S ₄ P ₄ A ₂ +4C(2).
Violet (238)	S ₅ P _{$\frac{2}{3}$} A _{$\frac{2}{3}$} C(3).
Larkspur (239-41)	S _{$\frac{2}{3}$} P _{$\frac{2}{3}$} A _∞ C ₃ .
Monkshood (242-4)	S _{$\frac{2}{3}$} P _{$\frac{2}{3}$} A _∞ C ₃ .
Buttercup (245)	S ₅ P ₅ A _∞ C _∞ .
Datura (246)	S(5)[P(5)A ₅]C(2).
Morning Glory (247)	S ₅ [P(5)A ₅]C(2).
Robinia (261-2, 275)	S _{$\frac{2}{3}$} P _{$\frac{2}{3}$} A ₍₃₎ C ₁ .
Gerardia (263)	S ₅ [P($\frac{2}{3}$)A $\frac{2}{3}$]C(2).
Pentstemon (264)	S ₍₅₎ [P($\frac{2}{3}$)A $\frac{2}{3}$ a ₁]C(2).
Catalpa (265)	S _{$\frac{2}{3}$} [P $\frac{2}{3}$ A ₂ a ₃]C(2).
Chicory (267, 380)	S _∞ [P _{$\frac{2}{3}$} A ₍₅₎]C(2).
Coreopsis (269a, 290-1)	S ₂ [P(5)A ₍₅₎]C(2).

Cherry (271)	S ₅ P ₅ A _∞ C-1.
Purslane (272)	S ₂ P ₅ A _∞ C-(3).
Hawthorne (273)	S ₅ ,P ₅ A ₁₀ C-(5).
Cranberry (274, 371)	S ₄ P ₄ ,A ₄ C(4).
Linden (277)	S ₅ P ₅ A _∞ +5C(5).
Cypripedium (284)	S ₁ ₁ ,P ₁ [a ₁ A ₁ C(3)].
Lobelia (285)	S ₅ ,P ₁ ⁽⁸⁾ A(5)C(2).

At first sight it may seem that only a very long description would answer all the questions applying to a given plant in the schedule provided. The following sample description of a flax plant will show how far this is from being the case.

Linum usitatissimum L. (Common Flax.)

Plant an annual, about 1-2 feet high, cultivated, or sometimes growing wild in fields along railroads, etc.; flowering and fruiting in summer. Stem exogenous, sparingly branched, erect, solid, terete, slightly grooved, glabrous and somewhat glaucous, becoming straw-colored with age and producing a tough, fibrous bark; arises from a slender tap-root. Leaves cauline, alternate, simple, net-veined, triple-ribbed, $\frac{1}{2}$ -1 in. long, lanceolate, sessile, acute, entire, glabrous above and below, rather thin, exstipulate. Flowering branches corymbosely clustered, the flowers erect, 1 in. broad, borne on slender glabrous peduncles, 1-2 in. long, from the axils of leaves. Flower S₅P₅A₅C₅. Calyx cup-shaped, persistent, the sepals broadly oval, short-acuminate, imbricate, the inner ciliate. Corolla spreading, fugaceous; the petals cuneate, twice the length of the sepals, crenate, convolute, membranaceous, blue. Stamens exserted; anthers somewhat versatile, introrse, dehiscing by longitudinal slits; filaments slender, nearly half as long as the petals, coherent at base and with slender intervening appendages. Ovary ovoid, 5-celled, each cell being again divided by a false partial partition; stigmas elongated, club-shaped, extending on slender styles slightly beyond the anthers; ovules two in each cell, anatropous and pendulous from an axile placenta. Fruit a capsule, broadly ovoid, incompletely dehiscent by the splitting of the false partitions, and also to some extent septicidal. Seeds 10, ovoid, flattened, 2-3 lines long, brown, smooth, mucilaginous when wet; embryo straight in rather scant albumen, both rich in oil; cotyledons two, equal plano-convex.

SCHEME FOR PLANT ANALYSIS.

THE PLANT. Is it an annual, a biennial, a perennial herb, a herbaceous vine, a woody vine, an undershrub, shrub or tree? What is the height or length? Mention if it is aquatic, epiphytic, saprophytic or parasitic, and if a parasite tell whether on the stem or root, and on what kind of plant. Where does it grow? When does it flower and fruit? Is the plant aromatic or rank-scented, or with a watery, resinous, milky or colored juice?

THE STEM OR TRUNK ABOVE GROUND. Is it exogenous or endogenous, simple or branched (sparingly or repeatedly?) erect, diffuse, declined, decumbent, ascending, prostrate or creeping, or is the plant acaulescent? Does it produce runners, suckers, stolons, offsets, bulblets, spines or thorns? If a vine, is it twining, or does it climb by means of hooks, roots, leaves, petioles, tendrils or adhesive disks? If herbaceous, is the main stem, or are its branches, solid or hollow, terete, flattened, triangular, quadrangular, grooved or otherwise peculiar in form? Is the surface glabrous, polished, glaucous, glandular, pubescent, woody, silky, rough, bristly, prickly or otherwise clothed or modified? What changes of surface or color, if any, occur with age? If bark is produced, what are the peculiarities (firm, soft, scaly, papery, furrowed, smooth, rough, white, red, yellow, grayish, etc.,) when young and when old? If the plant is woody, tell the color, grain (fine or coarse) and degree of hardness of the wood; state whether the plant forms terminal or lateral buds or both, and if there are any lateral ones, tell whether these are solitary in the axils or accompanied by accessory ones (collateral or superposed); tell also whether the buds are naked or scaly, resinous, downy or otherwise protected, and give size and general form.

UNDERGROUND PARTS. From what do the parts above ground arise? If from a rhizoma, corm or bulb, of what form and dimensions is this organ and what is the character of the roots springing therefrom? If tubers are produced, what is their form and size? If the parts above ground come directly from the root, is the latter a tap-root (woody or fleshy, slender, conical fusiform, napiform or spheroidal?) a branched primary root, a fascicled root, or is it composed of fibres?

LEAVES. If the plant is an herb, are the leaves partly or wholly radicle or cauline, floating, submerged or otherwise peculiarly placed? If an undershrub, shrub or tree, are the leaves evergreen or deciduous? Are they alternate, opposite, verticillate, or fascicled? State if they are simple, or if once compound, are they unifoliolate or pinnately or palmately bi-, tri-, quadri-, quinque-, or plurifoliolate? If pinnate, state whether the leaf ends in a tendril, and, if plurifoliolate, whether abruptly pinnate or with an end leaflet? If more than once compound, are the leaves bi- or tri-, pinnate, palmate or ternate; or are they pinnately, palmately or ternately decomposed?

If simple, are the leaves parallel-veined or pinnately or palmately net-veined? State if triple or quintuple ribbed. Mention if lobed, cleft or parted, prefixing the number of the divisions. Give the length and width.

In regard to the blade and its divisions, if there are any, describe: 1st, the general outline or shape (whether linear, lanceolate, oblong, elliptical, rhomboidal, oval, ovate, deltoid, orbicular, oblanceolate, spatulate, obovate, cuneate, acicular, subulate, filiform, squamiform, ensiform, terete, inequilateral, etc.); 2d, the base (whether tapering, acute, obtuse, rounded, truncate, auriculate, cordate, reniform, sagittate, hastate, clasping, decurrent, adnate, perfoliate, connate-perfoliate, equitant, etc., and state if sessile); 3d, the apex (whether acute, acuminate, obtuse, rounded, truncate, retuse, emarginate, obcordate, cuspidate, mucronate, aristate, etc.); 4th, the margin (whether entire, serrate, serrulate, doubly serrate, dentate, crenate, repand, sinuate, incised, ciliate, spiny, revolute, etc.); 5th, the upper and the under surface (same terms used as for stem); and 6th, the texture (whether thin, membranaceous, coriaceous, fleshy or otherwise peculiar).

In regard to the petiole, if present, give length, tell whether terete, channeled, compressed, margined, clasping or exhibiting other peculiarities, and describe the surface.

State if the leaf be exstipulate or if there are stipules are they foliaceous, adnate, ochreate, spinous, setaceous or otherwise peculiar in form, and are they persistent, deciduous, fugaceous or caducous?

If the leaves are compound, describe the leaflets as if they were simple leaves, mention whether stalked or sessile, stipellate or

exstipellate, and give the characters of form, surface, etc., of stipels, petiolules, rachis or rachises, if such are present. State whether the leaf is sessile, or if petiolate describe the petiole; and whether exstipulate, or if stipulate describe the stipules after the manner provided for simple leaves.

INFLORESCENCE. Are the flowers solitary or in a raceme catkin, spadix, head, glomerule, thyrus or panicle; in a simple or compound spike, corymb, umbel, cyme or fascicle; or if in a mixed inflorescence, what is the nature of the ultimate clusters and in what way are they grouped? If the flowers are in a cluster, give the general form and size of the inflorescence (whether compact or loose, elongated, pyramidal, rounded, flat, etc.), and state if there is more than one sort of flower in a cluster telling in what part of the inflorescence the different sorts are found.

Are the flowers or flower-clusters terminal or axillary; sessile, peduncled or borne on a scape; erect, nodding, secund or pendulous? If with a scape, peduncle, rachis or pedicels, give relative length and describe any peculiarities of form, surface or color; mention if naked, or, if not, describe any peculiarities of form, surface, color or texture of the bracts, spathe, involucre or involucels.

FLOWERS. Notice the number of organs (sepals, petals, perianth divisions, stamens and carpels, functional or rudimentary) in each circle; observe whether they are regular or irregular, free or coalescent (above, below or throughout), and whether those of successive circles are distinct or adnate, alternate or opposite; also if the ovary is inferior, half-inferior or superior. Express by a floral formula * the facts observed. If the flowers are of more than one sort construct a formula for each kind, and state if the plant is monœcious, diœcious or polygamous. Give the size of the flowers.

For calyx and corolla or perianth, describe :

1. The general form, whether spreading, wheel-shaped, saucer-shaped, cup-shaped, bell-shaped, urn-shaped, funnel-form, salver-form, tubular, personate, ringent, papillionaceous, strap-shaped, spurred, saccate, gibbous, inflated, etc.

* For description of floral formulas see page 2.

2. The shape and relative size of the sepals, petals, lobes, segments, divisions, tube, claw, limb, crown, spur, standard, wings, keel, labellum or other special parts.

3. The texture, whether membranaceous, firm, fleshy, waxy or otherwise peculiar.

4. The duration, whether caducous, fugaceous, deciduous or persistent.

5. The coloring and its distribution.

6. Any peculiarities of surface, markings, margin, outgrowths, appendages or odor, and,

7. The æstivation, whether valvate, induplicate, involute, reduplicate, open, convolute, imbricate, plicate or supervolute.

For the stamens, tell whether included or exserted, equal or unequal in length. Are the anthers adnate, innate or versatile; introse or extrorse; connivent, awned, beaked, tailed or otherwise appendaged? Is the dehiscence by pores, valves, slits or otherwise? Is the pollen powdery or in masses, and what is its color? If there are pollinia describe the form. Mention any peculiarities of the connective. State if the anthers are sessile, or, if not, mention any peculiarities of the filaments as regards form (whether slender or stout, straight or curved inwards, outwards, upwards, downwards or to one side, subulate, club-shaped, etc.), hairiness, irritability, elasticity, the presence of glands, etc.

For the pistils describe the form of the ovary, mention if stalked or on a disk, and tell the number of cells. Give the number and form of the stigmas or lobes of the stigma, mentioning whether plumose, flattened, linear, club-shaped, capitate, recurved, beaked, hairy, viscid or otherwise peculiar; state if sessile, and, if not, describe the style mentioning whether terminal or lateral, straight or curved (upwards, downwards or to one side), tapering, club-shaped, flattened, terete or angled (how many?), included or exserted, hairy, bearded or peculiar in other ways.

For the ovules, tell whether solitary, few or many in a cell, whether erect, ascending, horizontal, pendulous, or suspended, orthotropous, campylotropous, amphitropous or anatropous, and if there be a placenta or placentæ state whether axile or parietal.

FRUIT. Is it a berry, pepo, pome, drupe, akene, cremocarp, utricle, caryopsis, nut, acorn, samara, follicle, legume, loment,

capsule, silique, sillicle, pyxis or cone, or a cluster, aggregate or collection of such? If the fruit is not one of these kinds, tell whether it is dry or fleshy and what are its peculiarities. State if receptacle, calyx, bracts or other organs form an accessory part of the fruit, and describe any appendages, as wings, hooks, spines, barbs, hairs, etc. Tell the size, position and form of the fruit, and mention any peculiarities of color, surface, etc. If a capsule, is the dehiscence loculicidal, septicidal, loculicidal-septifragal, marginicidal-septifragal, or by pores at the top or bottom? If drupaceous, is the stone smooth or rough? If a cremocarp, describe the form of the mericarps, together with the number and position of the ribs and oil tubes.

For the seeds, state (if not already implied in the description of the fruit) whether solitary, few or numerous. If distinct from the fruit, tell the size, form, color, markings, and whether smooth, rough, wrinkled, hairy or otherwise characterized. If provided with an aril, caruncle, coma, wings, or other appendage, describe its peculiarities. State whether ex-albuminous, or if albuminous whether the albumen is mealy, oily, fleshy or hard, and whether the embryo is straight or coiled within, around or at one side of the albumen: minute, medium-sized or large. Is the embryo mono-, di- or polycotyledonous? If dicotyledonous mention if the cotyledons are foliaceous or fleshy: straight, folded, plicate, convolute, accumbent, incumbent, conduplicate, unequal or otherwise peculiar.



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